

## Short Report: Global Infectious Disease Surveillance at DoD Overseas Laboratories, 1999–2007

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**Abstract.** The United States Department of Defense Global Emerging Infections Surveillance and Response System (DoD-GEIS) conducted a review in 2008 of projects funded by DoD-GEIS at five partner overseas laboratories from 1999 through 2007. During this period, the annual overseas programming budget grew from US\$1.038 million to US\$21 million. The review describes the distribution of project priorities and geographic locations over the years, the types of outcomes the projects generated, and the frequency with which they involved collaboration with other public health agencies and organizations, including CDC and WHO. Areas for further program strengthening are identified.

### INTRODUCTION

Since 1946, the United States Department of Defense (DoD) has co-operated 20 laboratories with host-country agencies to study infectious diseases of mutual interest.<sup>1</sup> Five persist, based in Peru, Indonesia, Egypt, Thailand, and Kenya (Table 1). Since 1998, they have emphasized their role as regional public health laboratories through project support from the DoD Global Emerging Infections Surveillance and Response System (DoD-GEIS). DoD-GEIS was created in 1997 by the DoD as part of the US Government's response to a 1996 Presidential Decision Directive calling for increased effort to reduce the threat posed by emerging infectious diseases (EIDs) through "surveillance, training, research, and response."<sup>2</sup>

DoD-GEIS has made these overseas laboratories the backbone of its globally focused efforts. Projects supported at the laboratories have been collaborative efforts with host-country public health agencies and have focused on the surveillance of EIDs in local populations, the improvement of local EID surveillance infrastructure, and the professional development of host-country scientists and public health professionals.<sup>3</sup>

DoD-GEIS has undergone five external reviews: two by the Armed Forces Epidemiology Board (AFEB), two by the US Institute of Medicine (IOM), and one by the US Government Accountability Office (GAO).<sup>4–7</sup> Reviews by the AFEB considered the entirety of domestic and overseas DoD-GEIS programs, rather than focusing on the five overseas laboratories as this review does. The most recent reviews—GAO 2007 and IOM 2007—focused on limited components of DoD-GEIS overseas programs: capacity-building and influenza surveillance, respectively.

This review includes DoD-GEIS-funded projects at five DoD overseas laboratories for the period 1999–2007. Projects were selected by DoD-GEIS for funding on the basis of their scientific merit, their consistency with DoD-GEIS goals and disease/agent focus areas, and their military relevance or interest. The review describes the growth of the DoD-GEIS program at the overseas laboratories, analyzes the focus of the projects during this period with reference to the DoD-GEIS goals of surveillance, response, capacity-building, and cooperation, and discusses the importance of impact evaluation.<sup>8,9</sup>

### MATERIALS AND METHODS

The annual reports of projects funded by DoD-GEIS and executed at the five overseas laboratories between 1999 and 2007 were reviewed. All projects were funded for one year. Projects were categorized by primary objective and, if applicable, their disease or agent surveillance focus. DoD-GEIS has emphasized the surveillance of respiratory illness, gastrointestinal illness, febrile and vector-borne illness, antimicrobial resistance, and sexually transmitted infections. Project locations were recorded at the country level. Projects were categorized by reported outcomes: enhancement of physical host-country laboratory or surveillance infrastructure, training of host-country partners, response to local or regional disease outbreaks, direct epidemiologic support of deployed US troops, and publications in peer-reviewed journals. Last, projects were categorized by their reported collaborations with organizations identified as priorities for collaborations in DoD-GEIS strategic plans.<sup>8,9</sup>

### RESULTS

Between 1999 and 2007, DoD-GEIS supported 466 1-year projects with the annual number of projects trebling compared to 1999 (Figure 1). When broken down by primary objective, 343 (74%) were categorized as surveillance projects (Table 2). An additional 101 projects (22%) were almost evenly split between infrastructure enhancement (32, 7%), training (33, 7%), and outbreak response (36, 8%). Table 2 additionally shows average figures for 1999–2000 and for 2006–2007 in an attempt to compare the program at the commencement and conclusion of the period in question.

When surveillance projects ( $N = 343$ ) were characterized by their disease/agent focus or foci, 217 (63%) reported addressing febrile illnesses. Antimicrobial resistance was addressed by 122 (36%) projects, respiratory illnesses by 115 (34%) projects, gastrointestinal illnesses by 105 (31%) projects, and sexually transmitted infections by 17 (5%) projects. Cumulatively, from 1999 to 2007, DoD-GEIS-supported projects conducted work in 85 countries (Figure 1). The annual number of countries engaged grew from 13 in 1999 to > 45 between 2004 and 2007, with a peak of 53 in 2006.

Of surveillance projects ( $N = 343$ ), 193 (56%) reported conducting training and 150 (44%) reported enhancing physical infrastructure (Table 2). A composite value titled "capacity-building," which requires a project to have reported at least one of the preceding outcomes included 214 (62%) surveillance projects. Additionally, 50 (17%) projects reported responding

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14. ABSTRACT <b>The United States Department of Defense Global Emerging Infections Surveillance and Response System (DoD-GEIS) conducted a review in 2008 of projects funded by DoD-GEIS at five partner overseas laboratories from 1999 through 2007. During this period, the annual overseas programming budget grew from US\$1.038 million to US\$21 million. The review describes the distribution of project priorities and geographic locations over the years, the types of outcomes the projects generated, and the frequency with which they involved collaboration with other public health agencies and organizations, including CDC and WHO. Areas for further program strengthening are identified.</b>					
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TABLE 1  
DoD-GEIS Partner Overseas Laboratories

Abbreviation	Title	Location
NMRCD	Naval Medical Research Center Detachment	Lima, Peru
NAMRU-2	Naval Medical Research Unit-2	Jakarta, Indonesia
NAMRU-3	Naval Medical Research Unit-3	Cairo, Egypt
USAMRU-K	U.S. Army Medical Research Unit-Kenya	Nairobi, Kenya
AFRIMS	Armed Forces Research Institute of the Medical Sciences	Bangkok, Thailand

to at least one disease outbreak and 20 (6%) reported providing direct epidemiologic or diagnostic support for deployed US troops. Partner laboratories reported publishing 207 articles relating to GEIS supported work in peer-reviewed journals during the years under review. A large number of projects included organizational collaboration with the WHO (120, 26%) other DoD organizations (116, 25%), and the US CDC (95, 20%). Projects also reported collaboration with private and educational institutions 59 times (13%) and with USAID 25 times (5%).

## DISCUSSION

Between 1999 and 2007, DoD-GEIS overseas surveillance expanded significantly, measured by annual projects, countries engaged, funds awarded, and peer-reviewed publications. The majority of surveillance projects addressed one or more DoD-GEIS priority diseases or agents. Additionally, the majority of surveillance projects made investments toward local sustainability by training host-country scientists and investing in laboratory and public health infrastructure. These investments were considered critical to maintaining collaborative relationships with host-country scientists and officials. Furthermore, DoD-GEIS funded 65 projects with infrastructure development or training as their primary objective. These contributions were independently appraised by a GAO report that compared DoD (GEIS) overseas surveillance capacity-building efforts to those of CDC and USAID.<sup>4</sup>

We found a favorable level of collaboration with non-DoD agencies, both within the US Government and outside of it. These collaborations suggest that GEIS funds have been

leveraged with funding from other governmental organizations, creating a stronger whole. DoD has assigned liaisons to, hosted scientists from, and engaged in routine coordination with CDC and WHO, whereas collaborations with USAID and private and educational institutions have taken place on a more limited basis.

This review additionally identified a few areas that could be strengthened. First, only 5% of projects reported surveillance for sexually transmitted infections. This fifth disease or agent category was added as a DoD-GEIS priority after a 2004 Armed Forces Epidemiology Board Review without additional resources. Second, project reports document a small number of projects (25, 5%) involving collaborations with USAID. DoD-GEIS is intent on increasing collaboration, where appropriate. Additionally, this figure does not include coordination—not measured directly in this review—which has taken place frequently either in-country or through DoD-GEIS headquarters. Third, as a military organization, DoD-GEIS might be expected by some to involve > 6% of its projects in direct support of US troops. This number, however, comes only from DoD-GEIS overseas host-country collaborative surveillance efforts. DoD-GEIS surveillance efforts within the military health system—not considered here—contribute routinely and substantially to troop health. In addition, direct-support projects often took the form of providing epidemiologic support to major, multi-country military training exercises in Asia and North Africa.<sup>10–14</sup>

The presidential directive adding EID surveillance and response to DoD's responsibilities named the overseas laboratories because of their strategic positioning and considerable expertise. During the 1980s and 1990s, the Military Infectious Diseases Research Program prioritized funding toward the development of specific drugs and vaccines at the overseas laboratories. Through DoD-GEIS, National and DoD leaders sought to broaden the mission of the overseas laboratories, using stable, flexible funding to develop public health laboratory capacity for detecting and responding to EIDs.<sup>15</sup>

This emphasis on laboratory capacity as a first step toward disease detection followed from 1992 IOM recommendations that urged broad-based laboratory capacity to detect novel pathogens.<sup>16,17</sup> It also followed the logic of what former Secretary of Defense William Perry termed preventive diplomacy, the practice of addressing threats—emerging diseases in this instance—before they arrive in the United States.<sup>18</sup> Subsequently, in 2005, the DoD issued a directive regarding Support for Stability, Security, Transition, and Reconstruction (SSTR) Operations that elevated stability operations—including their humanitarian and public health components—to the same level of strategic importance as combat.<sup>19,20</sup> Both the surveillance of diseases and the trust engendered by capacity building can be viewed as furthering these goals.

The projects included in this review represent collaborative efforts with many public health professionals around the globe, through many ministries of health and defense, private institutions, the US CDC, and the WHO. The development and completion of these projects reflect successful partnerships. However, our consideration of the impact of these projects was limited to the peer-reviewed publications they generated, an important but narrow measure. Evaluating the lasting impact of the surveillance and capacity-building efforts on disease prevention and control was beyond the scope of this review.

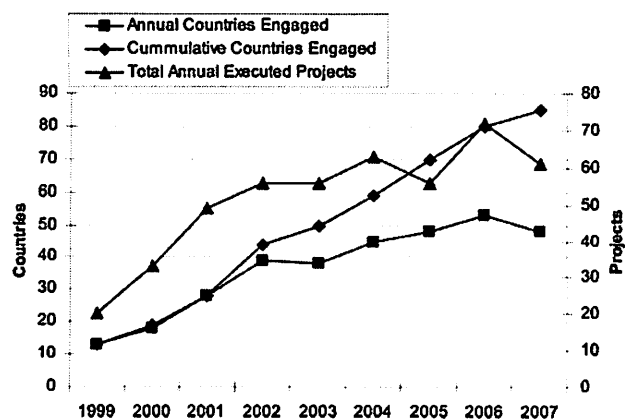


FIGURE 1. Annual and cumulative countries engaged and annual total projects, 1999–2007.

TABLE 2

Results, 1999–2007: projects by primary objective, disease or agent, outcome, organization collaboration, as well as publication in peer-reviewed journals

	Average 1999–2000	Average 2006–2007	Total	Percent of all
<b>Projects by primary objective (<i>N</i> = 466)</b>				
Surveillance	24	48.5	343	74%
Surveillance projects by disease/agent ( <i>N</i> = 343)*				
Respiratory illness	7.5	22	115	34%
Gastrointestinal illness	9	19.5	105	31%
Febrile illness	14	24	217	63%
Antimicrobial resistance	11	15.5	122	36%
Sexually transmitted infections	1	1.5	17	5%
Surveillance projects by select outcomes ( <i>N</i> = 343)*				
Training of foreign collaborators	13	28	193	56%
Physical infrastructure enhancement	10.5	19	150	44%
Capacity building†	14	30.5	214	62%
Response to ≥ 1 outbreak	2	7	58	17%
Direct support of deployed US troops	1.5	2	20	6%
Outbreak response	1	5.5	36	8%
Training	0	2.5	33	7%
Infrastructure enhancement	0	6	32	7%
Other	0	4	22	5%
Publications in peer-reviewed journals	7.5	51.5	207	n/a
<b>All projects by organizational collaboration (<i>N</i> = 466)*</b>				
WHO	3	12	120	26%
DoD and military health system organizations‡	9.5	9.5	116	25%
US CDC	6.5	8.5	95	20%
USAID	2.5	0	25	5%
Private and educational institutions§	5.5	5	59	13%

\*Not mutually exclusive categories.

†Either physical infrastructure enhancement, training of foreign collaborators, or both.

‡Other DoD-GEIS military partner organizations or other DoD organizations, not including DoD-GEIS Central Hub.

§Except private and educational partners within the host country.

Nevertheless, impact evaluation is critical to the maintenance and relevance of any surveillance system. In an age of budgetary scrutiny and many competing, worthy priorities, we are challenged to show the value of surveillance to a broader audience. Surveillance systems are typically measured by their execution of stated goals, rather than by their impact—primarily because such measurement is difficult and imprecise. Bearing in mind the ultimate goal of surveillance information leading to public health action, designing surveillance systems from the onset in a manner most conducive to impact measurement is advisable. A current priority of DoD-GEIS is to explore the most effective means of incorporating such measurement into our routine project reviews.

We have begun this process and it is worth mentioning, in the context of this narrow review, some of the system-wide accomplishments that have been described in the peer-reviewed literature. DoD-GEIS has consolidated and expanded DoD global influenza surveillance efforts—the program coordinates > 300 sites in 72 countries and contributes annual, geographically unique viral isolates to the WHO surveillance network that have been selected as seed viruses for vaccines.<sup>21</sup> DoD-GEIS scientists in Asia, East Africa, and South America have documented the continued spread of markers suggesting the potential for malaria drug resistance emergence—notably recent artesunate-class drug resistance—while working to standardize laboratory methodology and microscopy.<sup>22–30</sup> A collaboration between the National Aeronautics and Space Administration, USAMRU-K, and DoD-GEIS headquarters has developed an effective, satellite-based early warning tool for rift valley fever in East Africa and is now working to expand its applicability to other climate-dependent epidemic diseases.<sup>31–36</sup> The network has also overseen the development

and refinement of a series of systems designed to bring real-time disease surveillance to remote or low-resource settings, including Cambodia, Laos, Thailand, the Philippines, and Andean Ridge countries of South America.<sup>37–41</sup> GEIS partners at NAMRU-3 and WRAIR have additionally conducted revealing studies on the burden of diarrheal diseases among US and coalition troops in the Eurasian theater, recommending more aggressive empiric treatment.<sup>11–14,42–51</sup> Last, the DoD-GEIS network has supported the training of thousands of host-country scientists, epidemiologists, physicians, and laboratorians while simultaneously investing in physical laboratory capacity to extend the return on the local training.<sup>52,53</sup>

Looking forward, DoD-GEIS expects the five DoD overseas laboratories discussed herein to continue in their current roles, conducting infectious disease surveillance of value to their various stakeholders and serving as health ambassadors around the globe.

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